Session4　逆問題研究推進室「New frontiers in mathematical physics」

[総合研究棟 B107]

Key words:
wave motion, space-time behavior in Lorentz metric, general relativity, probabilistic scattering theory

13:30-14:30「An Inverse Problems for a Non-linear Wave Equation and Inverse Problems in General Relativity」

Matti Lassas (University of Helsinki)

Abstract:

We consider inverse problem for a non-linear wave equation with a time-depending metric tensor on manifolds. In addition, we study the question, do the observation of the solutions of coupled Einstein equations and matter field equations in an open subset U of the space-time M corresponding to sources supported in U determine the properties of the metric in a maximal domain where waves can propagate from U and return back to U. To study these problems we define the concept of light observation sets and show that these sets determine the conformal class of the metric.
The results have been done in collaboration with Yaroslav Kurylev and Gunther Uhlmann.
In addition to the above results we discuss the problems of geodesic tomography encountered in study of cosmic microwave background. These results are done in collaboration with Lauri Oksanen, Plamen Stefanov, and Gunther Uhlmann.

14:45-15:45「On Riemannian Geometry of the Einstein Equation」

Sumio Yamada (Gakusyuin University)

Abstract:

In this talk, we pose the Einstein/Einstein-Maxwell equation as a Cauchy problem, and look at the moduli space of the Cauchy data, each of which consists of a three dimensional Riemannian manifold and a deformation tensor.　Needless to say, the structure of the moduli space is elusive, but we use the so-call Penrose-type inequality to characterize the space. In doing so, the known exact solutions to the Einstein equations play an important role, which is closely related to the Cosmic Censorship first proposed by R. Penrose in the 1970's. This is a collaborative work with Marcus Khuri and Gilbert Weinstein.

16:15-17:15「Maximum a posteriori estimates in Bayesian inversion」

Tapio Helin (University of Helsinki)

Abstract:

A demanding challenge in Bayesian inversion is to efficiently characterize the posterior distribution. This task is problematic especially in high-dimensional non-Gaussian problems, where the structure of the posterior can be very chaotic and difficult to analyse. Current inverse problem literature often approaches the problem by considering suitable point estimators for the task.
Here we discuss the maximum a posteriori (MAP) estimate and its definition for infinite-dimensional problems. Moreover, we consider how Bregman distance can be used to characterize the MAP estimate. This is joint work with Martin Burger.